

**REMARKS FOR ADMINISTRATOR BOLDEN**

**INTERNATIONAL SPACE UNIVERSITY**

**SPACE STUDIES PROGRAM DISTINGUISHED LECTURE**

July 1, 2015

Thank you to Ohio University and Russ College of Engineering and Technology for inviting me to be with you during this public portion of the International Space University's (ISU) time in your community.

Wherever an ISU Space Studies Program travels, there's always a great opportunity for dialogue and exchange between the participants and the local community and we're delighted that this year the ISU is practically in the back yard of NASA's Glenn Research Center in Cleveland, a leading aeronautics and technology center that is critical to our journey to Mars.

I understand that there are 155 participants from 30 countries – and 150 more faculty members -- at this year's Space Studies Program. Now that's the kind of faculty to student ratio I like to see!

You know, those of you who are participating in the Space Studies Program are passionate about the future. You have a desire to advance humanity and to make this generation's next giant leaps in exploration.

Those of us here from NASA are here to support and guide you in whatever ways we can. Our hope is to partner with you and perhaps your native countries in the future. All of you who came here tonight to hear more about all of this play a role as well.

That's the great thing about space exploration. It unites all of us in a common and higher purpose. It excites and inspires us in ways that few things do.

If you are old enough to remember the moon landings, you know exactly where you were when Neil Armstrong first stepped onto the surface of the moon. If you're of more recent vintage, you may recall exactly where you were when NASA's *Curiosity* rover performed an unprecedented landing on Mars after 7 minutes of terror and a technologically complicated process that eased our little car-sized rover down to the Red Planet's surface.

Events like those inspire tomorrow's scientists and engineers even as they transform our understanding of the universe and give us an even deeper desire to go farther and search harder... to search for life on other planets, for instance. It's not just a concept of science fiction anymore. We're following the water and the clues on Mars and other places in our solar system and finding planets around other stars that could be like Earth.

We're also reaching for new capabilities. Technology drives exploration and we're working on things like solar electric propulsion and other technologies that will take humans beyond where we've already been.

We're also reaching for the stars by doing things like building telescopes that can peer back practically to the beginning of time.

These are the kinds of things on which we work every day at NASA and on which the International Space University prepares people to work around the world.

It's an amazing time for our field and really for everyone on the planet. We've made so many giant leaps in exploration years; it's truly an age of marvels; and many of our triumphs have come about because of partnership with other nations.

The Hubble Space Telescope, for instance, celebrated 25 years on orbit this year and its partners in space such as the *Chandra* X-ray Observatory, the *Spitzer* Space Telescope and others continue to return amazing views of our galaxy and its incredible phenomena. In 2018, the James Webb Space Telescope will travel a million miles from our planet to gain the best views ever of the cosmos in which our planet is but a tiny fragile corner.

During this year's Space Studies Program, we will reach a historic milestone as the *New Horizons* spacecraft, after 9 years and billions of miles of travel, makes the closest flyby of Pluto ever. In fact, it's the only spacecraft that has had Pluto as its primary destination. On NASA's website, you can already see the images of the Pluto system coming into greater focus every day and on July 14 we'll be graced with the clearest pictures ever of this mysterious object at the edge of our solar system.

I don't know about you, but as a kid, I saw artists' renderings of the solar system in my classroom and that little rock way at the end was something almost intangible. It was so far away; it seemed impossible that we'd ever know much more about it. But now we will, and with that flyby, we will have observed in some detail every single planet of our solar system. Not that we're calling the job done by any means.

Next year, the *Juno* spacecraft enters a polar orbit around our big, distant neighbor Jupiter and you can prepare to have your minds blown by those images and what we discover.

I'm also very excited that we've gotten the go-ahead to select instruments for a robotic mission to Jupiter's mysterious moon Europa, which is believed to be a water moon with more water than the total of Earth's oceans. It is proving intriguing and very interesting to scientists looking for signs of life in our own solar system.

Next year we also launch a lander to Mars called *InSight*, which will study the planet's core. It joins orbiters and rovers already on Mars paving the way for human missions there in the 2030s. In the coming years we will also partner with other nations on other Mars rovers and other missions to the Red Planet.

This fall, our scientists will convene a conference to begin the discussion about where humans might actually land on the Red Planet. Proposals will be collected on areas that would be of high scientific research value while also providing natural resources to enable human explorers to safely land, live and work on Mars. It marks the first time NASA has ever actively begun the process of selecting specific landing sites for a human mission to Mars, and it is further evidence of the extraordinary progress we are making on that journey. It will also take advantage of assets with finite lifetimes like the Mars Reconnaissance Orbiter and the *Odyssey* spacecraft in orbit now.

I think we'd all agree, however, that the most important planet is this one on which we live. In the past year and a half, we launched five new Earth science missions, including two new instruments to the International Space Station, that are part of a fleet of 20 missions that are vastly enhancing our understanding of our changing planet. From ocean winds, to components in the atmosphere to soil moisture, we're gathering data to understand climate change and its effect on our food supply, predicting and responding to natural disasters and joining other nations to become better stewards of our home.

Many of these missions I've just mentioned, from Hubble to the International Space Station, are missions involving international cooperation. Our work is now truly in global in content and nature.



When you witness Earth from orbit, seeing a sunset or a sunrise every 45 minutes, you get quite a different perspective on things. When I was flying in space, we didn't have an International Space Station. Our space shuttles were our lifeboats and our homes and we began to fly international crewmembers. I'm so proud of the many shuttle missions that flew experiments, deployed satellites and later made the construction of the International Space Station possible.

Now we have that orbiting outpost – a true first in the history of humanity. Not since November 2, 2000, when Expedition 1 docked, has every human now living been on the surface of Earth at the same time. That's how long we've had continuous habitation of the Station by crewmembers of many nations.

With the retirement of the shuttle, we looked to American industry to help develop our next launch capabilities and the progress of the past few years has been extraordinary.

Now of course, just this week we suffered a setback in the efforts of our commercial partners with the loss of SpaceX's seventh commercial resupply mission to the Station.

While we are disappointed at this outcome, I want to stress that the astronauts are safe aboard the Station and have sufficient supplies for the next several months. We will work closely with SpaceX to understand what happened, fix the problem and return to flight.

The commercial cargo program was designed to accommodate loss of cargo vehicles and we will continue operation of the Station in a safe and effective way as we continue to use it to help us prepare for longer duration missions farther into the solar system.

We're in a lot better place than we were, for instance, in the mid-1980s, when successive failures of every launch system we had at the time, from the shuttle to Titan, Delta and Atlas rockets, nearly completely grounded us. That was a real wake-up call, and the changes in policy toward greater commercialization and cooperation are paying off now.

Now we have some options to help us bounce back. A *Progress* vehicle is ready to launch this Friday, July 3, followed in August by a Japanese *HTV* cargo flight. Orbital *ATK*, our other commercial cargo partner, is moving ahead with plans for its next launch later this year.

SpaceX has demonstrated extraordinary capabilities in its first six cargo resupply missions to the Station and we know they can replicate that success. We will work with and support them to assess what happened, understand the specifics of the failure and correct it to move forward.

Sunday's loss of mission is a reminder that spaceflight is an incredible challenge, but we learn from each success and each setback. The failure of this launch attempt will not deter us from our ambitious human spaceflight program.

As Bill Gerstenmaier, the head of our Human Operations and Exploration Mission Directorate, said this weekend, finding and correcting a problem now with the Falcon 9 will help strengthen our work on commercial crew transportation.

So I remain confident that in in just a couple of years, Boeing and SpaceX will be carrying astronauts to the Station once again on the systems of American companies, launched from the United States.

Some of you in the audience may not realize what a milestone that is, but the growing maturity of commercial space – first to deliver cargo to the Station and next to transport astronauts once again to low Earth orbit from the United States – is one of the most amazing things of the past few years in our field.

Some of you may have heard that Congress is underfunding this effort. I sincerely hope we can work out a way to get the full funding we have requested for our partnerships in commercial space. As I said three weeks ago after a Senate Subcommittee on Appropriations vote on our budget, I support investing in America so that we can once again launch our astronauts on American vehicles and stop relying solely on the Russians. I can't stress this enough – if we don't get the funding we need, we'll be delayed in getting astronauts aboard the systems of American companies at a time when our partners are making great strides and innovating to bring those launches back to this country.

But I do have full confidence in those partners' work and the future of our nation's exploration program. We'll be swearing in a new class of astronaut candidates soon and it's not anywhere close to being the final group. So keep that in mind, those of you pursuing your degrees today at Ohio University. Your generation is going to be the one going to Mars and we need you.

We're committed to the Space Station through at least 2024 and it's our springboard to the rest of the solar system. It's a place where international crews perform research on human health and on materials development that you can't do on Earth. It's a place where new technologies are demonstrated and the astronauts themselves are guinea pigs that are helping us learn about the true effects of living and working in space for the long term.

Right now astronaut Scott Kelly, along with Cosmonaut Mikhail Kornienko, is midway through a historic one-year mission aboard the Station.

It will be the longest an American has ever been in space. Scott's vital signs will be compared to his twin brother's here on Earth in an unprecedented experiment called the Twins Study.

I can tell you first hand, for the human body, everything changes in space. Up and down lose their meaning and your body, so used to the confines of gravity, does all kinds of crazy things once it doesn't have those bonds any longer. If we're going to travel deeper into space, we need to understand what happens to humans, physiologically and mentally on long missions, how to protect them and how to enable them to successfully learn to live at what are certain to be the harsh destinations at the end of their travels.

We're learning to do amazing things, though, like transform the components of dirt into water and oxygen. We're examining how plants grow in microgravity. We're demonstrating technologies for landing on other planets.

We're testing new kinds of habitats that could successfully house the fragile human species away from our planet because our journey to Mars has already begun.

Just this past week, we did another test at the Stennis Space Center in Mississippi of the RS-25 engines that will power the core stage of the Space Launch System rocket that will carry the *Orion* spacecraft to orbit and bring humans once more to deep space. The RS-25 engine is a modified space shuttle main engine, which powered missions into low-Earth orbit for 30 years. Remaining space shuttle main engines are being upgraded to provide the additional thrust needed for the SLS vehicle.

This test will help engineers verify the performance of the engine's controller, which monitors and regulates performance during firing. Testing of RS-25 engines that will be used for flight is expected to begin this fall at Stennis and each of these tests moves NASA a step closer to a new era of space exploration.



That *Orion* spacecraft I mentioned has already has its first flight as well, traveling to deep space in December – farther than any human-rated craft has gone in more than 40 years. It returned safely to Earth and right now is yielding its data about our new heat shield, parachutes and many other systems. It also carried a student radiation shielding experiment, helping to tie that critical test to the next generation that will be responsible for our missions to Mars and wherever else we plan to go.

Another thing I want to stress is that all of this work off the planet is for the planet. Every dollar we spend on exploration is spent here on Earth. Places like the Glenn Research Center in Cleveland are innovation centers for the region in which they're located.

The benefits of exploration are not only the new technologies that are spun off for everyday use, but also in new knowledge about our planet and our own health, as I mentioned, and in practical applications like an improved air traffic system.

I'm a pilot, so the work that Glenn does is near and dear to my heart. The center is part of a network of aeronautics innovation centers that makes it possible for me to say that "NASA is with you when you fly" because technologies we helped develop are in virtually every aircraft in service as well as the control towers guiding them.

We just demonstrated a technology that allows an aircraft to shed bug guts in flight. Really! It's a problem – especially in the South! We're also looking at getting supersonic aircraft back into service and also making the whole system safer and greener. So stay tuned on that one. You don't have to be an astronaut to appreciate a better flying experience.

In the final analysis, I couldn't be more excited about our future. We're making steady progress and continuing to reach for new heights.

We're making our mark on history, and along the way we're inspiring a whole new generation of scientists, engineers and astronauts. That's why we're dedicated to science, technology, engineering and mathematics education – the kind of thing that goes on daily here at Ohio University and the Russ Center – and broadening the pipeline to develop the leaders of the future.

I want every American to feel the pride that all of us who work at NASA have for our space program. I want partners around the world to be inspired to reach out to NASA with their big ideas and to take the sometimes daunting steps to engage their own citizens in exploration and its benefits.

NASA is an incredible investment for our nation because what we do not only uncovers new knowledge; it helps raise the bar of human achievement.

People everywhere are attracted to what we do, because exploration embodies our values as a nation - resilience, hope, overcoming the challenges faced. As I said, space is hard. It always will be. But we share a willingness to learn from our mistakes so that we can transform the impossible into the possible.

Together with our commercial, academic and international partners we're launching the future. With the continued support of the Administration, the Congress and the American people – and communities like the one here in Athens – we'll all get there together.

Thank you